

### **Remarks**

Reconsideration of the application is respectfully requested in view of the foregoing amendments and following remarks. Claims 1, 3-10, 12-15, 17-24, and 26-32 are pending in the application. No claims have been allowed. Claims 1, 6, 12, 14, and 24 are independent. Claims 1 and 6 have been amended. Claim 8 has been canceled without disclaimer and without prejudice to pursuing in a continuing application.

### **Cited Art**

The Office action (“Action”) applies the following cited art: U.S. Patent No. 6,981,249 to Knoblock et al. (“Knoblock”) and U.S. Patent No. 7,117,488 to Franz et al. (“Franz”).

### **§ 102 Rejection**

The Action rejects claims 1, 3-8, 14, 17-23 and 29-31 under 35 U.S.C. § 102(e) as being anticipated by Knoblock. Applicant respectfully submits that the claims are allowable over Knoblock. To establish a prima facie case of anticipation, the cited art must show each and every element as set forth in a claim. MPEP § 2131.

### **Claim 1**

Claim 1 recites (emphasis added):

A method of type-checking a code segment written in a programming language comprising:

translating the code segment from the programming language to one or more representations of an intermediate language, *wherein the one or more representations of the intermediate language are capable of representing programs written in a plurality of different source languages, wherein the plurality of different source languages comprise at least one typed source language and at least one untyped source language;* and

*type-checking the one or more representations based on a rule set, wherein the rule set comprises rules for type-checking a type designated as an unknown type, wherein the unknown type indicates that an element of the representation is of a type that is not known.*

Knoblock’s description of reconstructing types does not teach or suggest “wherein the one or more representations of the intermediate language are capable of representing programs written in a

plurality of different source languages, wherein the plurality of different source languages comprise at least one typed source language and at least one untyped source language” or “type-checking the one or more representations based on a rule set, wherein the rule set comprises rules for type-checking a type designated as an unknown type, wherein the unknown type indicates that an element of the representation is of a type that is not known,” as recited by claim 1.

Knoblock is directed to type reconstruction. As Knoblock describes, when a source program is translated (e.g., compiled) to produce a bytecode program, some types that were present in the source program are lost. Knoblock, col. 5, lines 59-66. Knoblock states that before type checking can begin, a program must have types, “But to even begin the process of type checking a program, the program has to have types.” Knoblock, col. 5, lines 58-59. Therefore, Knoblock provides a solution for reconstructing types that were lost during translation of a source program to a bytecode program. Knoblock, col. 5, line 58 to col. 6, line 13. The solution described by Knoblock for reconstructing types involves a constraint collection technique. Specifically, Knoblock states, “the embodiments of the present invention provide a constraint collection technique to learn from the remaining portions of the method 320 to solve for the type of the local variable x.” Knoblock, col. 7, lines 21-31. Knoblock describes one method for reconstructing types involving labeling variables as unknown, collecting constraints between known types and unknown types, and solving for the unknown types using the constraints. Knoblock, col. 8, lines 4-55.

Knoblock’s does not teach or suggest “*wherein the one or more representations of the intermediate language are capable of representing programs written in a plurality of different source languages, wherein the plurality of different source languages comprise at least one typed source language and at least one untyped source language*” as recited by claim 1. For example, see the Application at page 3, lines 5-14 and page 5, lines 22-27. Instead, Knoblock generally describes “a program that is written in a computer programming language, such as Java.” Knoblock col. 5, lines 32-35.

Furthermore, Knoblock does not teach or suggest “*type-checking the one or more representations based on a rule set, wherein the rule set comprises rules for type-checking a type designated as an unknown type, wherein the unknown type indicates that an element of the representation is of a type that is not known*” as recited by claim 1. The Examiner argues that Knoblock describes an unknown type that “remains unknown for the type checking.” Action, page 2,

citing Knoblock at col. 13, lines 35-52. Applicants respectfully disagree. Knoblock does not describe rules for type checking a type designated as an unknown type. The section of Knoblock cited by the Examiner describes determining constraints for array types. Knoblock determines constraints for array types so that Knoblock can assign types. As described above, Knoblock produces “reconstructed types in the intermediate program.” Knoblock col. 6, lines 8-9. The statement made in Knoblock regarding “disregarding the unknown element types if the two unknown array types are not an array type,” as understood by Applicants, means that the process (Fig. 10 of Knoblock) is not performed if it is discovered that the unknown array type is not an array type (As Knoblock states, Fig. 10 is “a method for collecting constraints for array types”), in which case Knoblock has other methods for determining types using constraints. Knoblock’s description of “disregarding” in no way teaches or suggests rules for type checking a type designated as an unknown type.

For at least these reasons, Knoblock does not teach or suggest the language of claim 1. Therefore, claim 1 should be in condition for allowance.

#### **Claim 6**

Claim 6 has been amended with language similar to dependent claim 8. For at least the reasons stated above with regard to claim 1, Knoblock does not teach or suggest “type-checking the one or more representations based on a rule set, wherein the rule set comprises rules for type-checking the type designated as the unknown type,” as recited by claim 6. Therefore, claim 6 should be in condition for allowance.

#### **Claim 14**

For at least the reasons stated above with regard to claim 1, Knoblock does not teach or suggest “one or more rule sets comprising rules associated with the type, designated as the unknown type, indicating an element can be of any type; and a type-checker for applying the one or more rule sets to the elements of the intermediate representation,” as recited by claim 14. Therefore, claim 14 should be in condition for allowance.

#### **Claims 3-5, 7, 17-23, 29-31**

Claims 3-5, 29, and 30 depend on claim 1. Thus, for at least the reasons set forth above with

regard to claim 1, claims 3-5, 29, and 30 should be in condition for allowance.

Claims 7 and 31 ultimately depend on claim 6. Thus, for at least the reasons set forth above with regard to claim 6, claims 7 and 31 should be in condition for allowance.

Claims 17-23 ultimately depend on claim 14. Thus, for at least the reasons set forth above with regard to claim 14, claims 17-23 should be in condition for allowance.

### **§ 103 Rejection**

The Action rejects claims 9, 10, 12-13, 15, 24-28 and 32 under 5 U.S.C. § 103(a) as unpatentable over Knoblock in view of Franz. Applicant respectfully submits that the claims are allowable over these references.

#### **Claims 12 and 24**

Claim 12 recites (emphasis added):

replacing the types associated with the plurality of programming languages with the types of the intermediate language, wherein the types of the intermediate language comprise general categories of the types associated with the plurality of programming languages and a type designated as an unknown type, *wherein the type designated as the unknown type has size information associated with it, wherein the size information comprises size information of a machine representation of the type designated as the unknown type.*

Claim 24 recites (emphasis added):

*wherein the type indicating that an element of the intermediate language is associated with the type designated as the unknown type has a size associated with it, wherein the size represents size of a machine representation of the type designated as the unknown type.*

The Examiner argues that Franz teaches the above-cited language of claims 12 and 24 respectively, citing Franz description of array size at col. 11, line 63 to col. 12, line 11. Applicants respectfully disagree. Franz describes size with relation to array indexing (bounds), so that array indexes are safe, “Similarly, for an array arr, a matching type safe-index-arr is provided, whose instances may assume only values that are index values within the legal range defined for the array arr.” Franz, col. 11, line 63 to col. 12, line 11. Furthermore, Franz states, “The size of an array may not be known statically, but once the array object has been created, its size will remain constant.” Franz,

col. 12, lines 5-7. Franz describes the need for enforcing array index checking at col. 1, line 60 to col. 2, line 3:

Assume an array is declared as having ten elements. A malicious code provider might wish to access array element eleven, thereby circumventing the type rules and gaining access to whatever variable happened to be located at the memory location corresponding to element eleven of the array--even if that variable is marked as being private or protected. Many exploits of security holes use this route, using a breach of type safety to modify variables that they normally would not have access to. Type safe code prevents this by disallowing the referencing of array elements beyond those defined to be in the array.

As described by Franz, array indexes may be made safe. Checking array index bounds does not require a machine representation size of array element types. For at least these reasons, Franz does not teach or suggest that a type designated as an unknown type with associated machine-representation size information associated with the unknown type.

Knoblock separately or in combination with Franz, does not teach or suggest the above-cited language of claims 12 and 24, respectively. Therefore, claims 12 and 24 should be in condition for allowance.

#### **Claims 9, 10, 13, 15, 26-28, and 32**

Claims 9 and 10 ultimately depend from claim 6, claims 15 and 32 ultimately depend from claim 14. Therefore, for at least the reasons stated above with regard to claims 6 and 14, Knoblock does not teach or suggest the language of claims 9, 10, 15, and 32 (as dependent on their respective independent claims) cited above. Furthermore, as understood by Applicants, Franz does not add sufficient disclosure to teach or suggest this language. Thus, claims 9, 10, 15, and 32 should be in condition for allowance.

Claim 13 depends on claim 12. Thus, for at least the reasons set forth above with regard to claim 12, claim 13 should be in condition for allowance.

Claims 26-28 depend on claim 24. Thus, for at least the reasons set forth above with regard to claim 24, claims 26-28 should be in condition for allowance.

### **Request for Interview**

If any issues remain, the Examiner is formally requested to contact the undersigned attorney prior to issuance of the next Office action in order to arrange a telephonic interview. It is believed that a brief discussion of the merits of the present application may expedite prosecution. Applicants submit the foregoing formal Amendment so that the Examiner may fully evaluate Applicants' position, thereby enabling the interview to be more focused.

This request is being submitted under MPEP § 713.01, which indicates that an interview may be arranged in advance by a written request.

### **Conclusion**

The claims should be allowable. Such action is respectfully requested.

Respectfully submitted,

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